

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 August 2003 (28.08.2003)

PCT

(10) International Publication Number  
**WO 03/071335 A2**

(51) International Patent Classification<sup>7</sup>: **G02B 27/00**

(21) International Application Number: **PCT/IB03/00419**

(22) International Filing Date: 6 February 2003 (06.02.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
02075687.0 20 February 2002 (20.02.2002) EP

(71) Applicant (for all designated States except US): **KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]**; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FEENSTRA, Bokke, J. [NL/NL]**; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **VAN DE WALLE, Gerjan, F., A. [NL/NL]**; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). **PRINS,** Menno, W., J. [NL/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

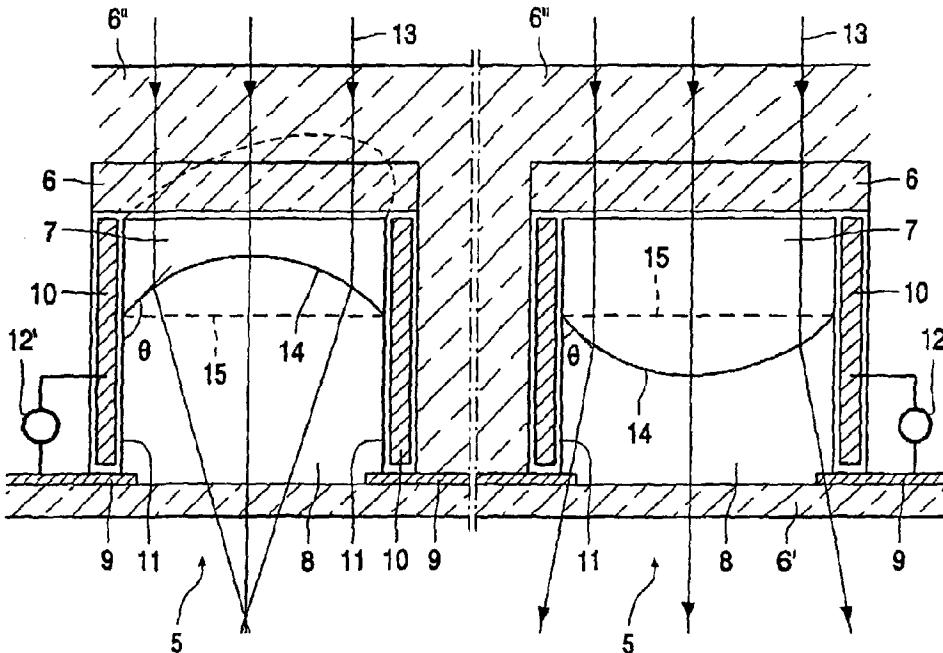
(74) Agent: **RAAP, Adriaan, Y.**; Internationaal Octrooibureau B.V., Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: DISPLAY APPARATUS



**WO 03/071335 A2**

(57) Abstract: In a 2D/3D display, a switchable lenticular array having foci which can be switched in a continuous way between first focal strength and a second focal strength is provided. The switchable lenticular array comprises fluid cylindrical lens portions, while the foci can be controlled by electrowetting.



**Published:**

— without international search report and to be republished upon receipt of that report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## Display apparatus

The invention relates to a display apparatus comprising a display device for displaying images comprising pixels, and further comprising means for switching between different types of images of the pixels. Examples of such display apparatuses are, for example, displays which can display both stereo images and plane images. The images to be displayed may originate from various types of display devices such as, for example, light-modulating display devices, for example, LCD panels or micromechanical panels, but also from light-generating display devices, for example, (poly)LED panels, plasma panels or even CRTs.

10

An example of such a display apparatus which is suitable for both three-dimensional and two-dimensional display is shown in USP 6,069,650. This document shows an LCD panel with an array of lenticular elements which are arranged with respect to the pixels in such a way that, in the case of three-dimensional display, sub-pictures are generated for the left and the right eye. The lenticular elements are situated in a space filled with an electro-optical material, for example, a liquid crystal material whose refractive index is switchable between a first and a second value.

By choosing one of the two values to be substantially equal to that of the material of the lenticular elements, the lens action is eliminated in one of the two states so that a two-dimensional image is shown. In the other state, the liquid crystal material has a refractive index which differs from that of the material of the lenticular sheet. By suitably driving the pixels, the information of both eyes is now different (three-dimensional image).

For a suitable liquid crystal material (with a small temperature dependence), the difference of refractive index between the two states is such (of the order of 0.2) that a large curvature is necessary for the elements which are lenticular in this case, so that the layer of liquid crystal material has thickness differences and hence an uneven switching behavior.

Moreover, the liquid crystal material is anisotropic. This means that, for the light passed through the liquid, the difference of refractive index between the ordinary and extraordinary refractive index is not the same in all directions. Consequently, the behavior of

the display device, if optimized for one viewing angle, will be poor for other viewing angles (angle dependence).

5 It is, inter alia, an object of the present invention to obviate said drawbacks as much as possible. According to the invention, the means for switching between the different types of images comprise at least one reservoir containing at least two substantially immiscible fluids having a different refractive index and a different electrical conductivity, and the means for switching between the different types of images are also provided with  
10 drive means for varying the shape of an interface between the fluids.

Since the elements with a lens action comprise an isotropic medium, said angle dependence is negligible. Moreover, the difference of refractive index between suitable fluids and air is usually larger than said 0.2 (in a typical example about 0.48) so that it is sufficient to use a smaller thickness of the lenticular sheet. In practice, two fluids will  
15 generally be used, preferably with substantially the same density, so that the assembly will be independent of the force of gravity.

The light-transmissive part does not require any (ITO) electrodes or coating so that the transmission is enhanced.

20 The lenticular elements may constitute both positive and negative lenses. For switching between a two-dimensional and a three-dimensional display, the display apparatus comprises two immiscible fluids having a different refractive index, one of which is electrically conducting and one is substantially insulating, while the shape of the interface is switchable between a curved and a flat surface.

25 In a first embodiment, the reservoirs have a substantially circular cross-section, viewed in the direction of an image plane. However, the reservoirs preferably have a substantially rectangular or hexagonal cross-section, which yields a larger effective surface area.

These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiments described hereinafter.

30

In the drawings:

Fig. 1 is a diagrammatic cross-section of a lenticular element according to the invention,

Fig. 2 is a cross-section of a display device according to the invention, taken on the line II-II in Fig. 3,

Fig. 3 is a plan view of the display device of Fig. 2,

Fig. 4 is a plan view of another lenticular element according to the invention,

5 Figs. 5 and 6 are cross-sections taken on the lines V-V and VI-VI in Fig. 4,  
while

Figs. 7 and 8 are plan views of other display devices according to the invention, and

Fig. 9 shows a typical application.

10 The Figures are diagrammatic and not drawn to scale; corresponding parts are generally denoted by the same reference numerals.

15 Fig. 1 shows the principle of a lens with variable focal length as used in the present invention. The lens of Fig. 1 comprises a reservoir 5 having transparent walls 6. In this embodiment, the reservoir 5 has a substantially circular cross-section in a plane transverse to the plane of the drawing. In this embodiment, a plurality of reservoirs is provided on one substrate 6', diagrammatically denoted by means of broken lines 6".

20 The reservoir 5 of, for example, glass but preferably of a synthetic resin material is arranged in such a way that it is filled, on the one hand, with a first insulating fluid 8, for example, an alkane, such as hexadecane or a silicon oil and, on the other hand, with a polar liquid 7 such as water or a salt solution (for example, KCl dissolved in a mixture of water and ethylalcohol).

25 First electrodes 9, in this embodiment provided on the substrate 6', project into the polar liquid 7 while second electrodes 10 are situated in the walls of the reservoirs. The electrodes 10 are insulated from the fluid 7 by means of an insulating layer 11. By means of voltage sources 12 shown diagrammatically between the electrodes 9, 10, the curvature of the meniscus between the two fluids 7, 8 can be influenced (electrowetting). Dependent on the used voltage, the contact angle  $\theta$  will assume a certain value. In the left-hand part of Fig. 1 (situation (a)) the contact angle  $\theta$  is larger than 90 degrees in this example and the meniscus 14 between the fluids 7, 8 will assume a curvature upwards so that the assembly of the reservoir 6 and fluids 7, 8 functions as a positive lens for incident light (arrows 13). In the right-hand part of Fig. 1 (situation (b)) the contact angle  $\theta$  is smaller than 90 degrees in this example and the meniscus 14 between the fluids 7, 8 will assume a curvature downwards so

that the assembly of the reservoir 6 and fluids 7, 8 functions as a negative lens for incident light (arrows 13).

The insulating layer 11 preferably has such wetting properties that the contact angle ( $\theta$ ) is 90 degrees at a given adjusting voltage. The meniscus 15 between the fluids 7, 8 is now flat. In that case, there is no lens action so that a two-dimensional image is shown. Dependent on the supplied voltages, a lens action can be introduced with a focus which may vary between a given negative and a given positive value.

Fig. 2 is a diagrammatic cross-section and Fig. 3 is a plan view of a part of a display device 1 with a liquid crystal panel 2 comprising a plurality of pixels 3. The display device is provided in the conventional manner with a (flat) light source or backlight 4. For the sake of simplicity, only the pixels 3 and the backlight 4 are shown. Substrates and other possible elements such as polarizers, retardation foils, etc. are not shown in Fig. 2.

In the embodiment of Fig. 1, the reservoirs have a substantially circular cross-section as viewed in the direction of an image plane. Moreover, each reservoir is associated with only one pixel. This will be at the expense of the effective aperture at the area of the part denoted by the shaded area 16 in Fig. 3. The reservoirs are therefore preferably associated with a plurality of pixels and have a substantially rectangular (or hexagonal) cross-section which is diagrammatically denoted by the rectangle 17 in Fig. 3. This yields a larger effective surface. Such a reservoir is diagrammatically shown in Figs. 4 to 6 in which the reference numerals denote the same components as those in Fig. 1. When the insulating layer 11 has such wetting properties that the contact angle ( $\theta$ ) is 90 degrees at a voltage of 0 V, the electrodes 10" (and the associated voltage source, not shown) can be dispensed with. Alternatively, adjustable voltages at the electrodes 10 (10', 10") may be used for each reservoir so as to obtain a more uniform lens behavior for the entire display device by adjusting the lens action per pixel or group of pixels. This lens behavior may be dependent on the material used and on the location of the reservoir on the surface of the display device. The variable adjustment may also be used for other purposes, for example, for adapting the curvature, dependent on the viewer's distance.

Fig. 7 shows an embodiment in which, viewed in a plan view, the sides 18 of the reservoirs extend at an (acute) angle  $\alpha$  with respect to the direction 19 of columns of pixels. The loss of resolution is spread across the row and column direction so that a less striped image is shown. However, there is still mutual crosstalk. This is prevented in the device of Fig. 8 in which the rows 20 of reservoirs 17 (coupled to a plurality of pixels) and the rows 21 of reservoirs 17' are offset with respect to each other.

Fig. 9 finally shows how the display device 1 of Fig. 1 can be used. This Figure shows a part of the panel 2 with a part of the reservoir 6 and some typical light paths associated with pixels (or columns of pixels) A, B, C, D. Fig. 9A is related to the situation of the second state described hereinbefore, in which light of each pixel (or columns of pixels) A, 5 B, C, D is reflected by a lenticular meniscus (denoted by dotted lines, solid lines, broken lines and dot-and-dash lines, respectively). Due to the lens action of the lenticular elements, the light of the pixels (or columns of pixels) A, B, C, D is deflected in different directions and a viewer 22 sees light from different pixels with different eyes (stereo image). In fig. 9B, related to the situation of the state described above with a flat meniscus, the lens action is 10 eliminated and the viewer sees all pixels (or columns of pixels) A, B, C, D with each eye.

If necessary, extra lens action can be obtained by providing the upper surface of the reservoir 5 with a curvature or by means of an auxiliary lens.

The invention resides in each and every novel characteristic feature and each and every combination of characteristic features. Reference numerals in the claims do not 15 limit their protective scope. Use of the verb "comprise" and its conjugations does not exclude the presence of elements other than those stated in the claims. Use of the article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

## CLAIMS:

1. A display apparatus comprising a display device for displaying images comprising pixels, and further comprising means for switching between different types of images of the pixels, wherein the means for switching between the different types of images comprise at least one reservoir containing at least two substantially immiscible fluids having a different refractive index and a different electrical conductivity, and are also provided with drive means for varying the shape of an interface between the fluids.
2. A display apparatus as claimed in claim 1, comprising two immiscible fluids having a different refractive index, one of which is electrically conducting and one is substantially insulating, while the shape of the interface is switchable between a curved and a flat surface.
3. A display apparatus as claimed in claim 1, comprising reservoirs having a substantially circular cross-section, viewed in the direction of an image plane.
4. A display device as claimed in claim 1, comprising reservoirs having a substantially rectangular or hexagonal cross-section, viewed in the direction of an image plane.
5. A display apparatus as claimed in claim 4, wherein, viewed with respect to rows of pixels, sides of the reservoirs extend at an acute angle to the direction of rows of pixels.
6. A display apparatus as claimed in claim 4, wherein, viewed in consecutive rows of reservoirs, the reservoirs are offset with respect to each other.
7. A display apparatus as claimed in claim 1, comprising a common reservoir for a plurality of pixels.

1/5

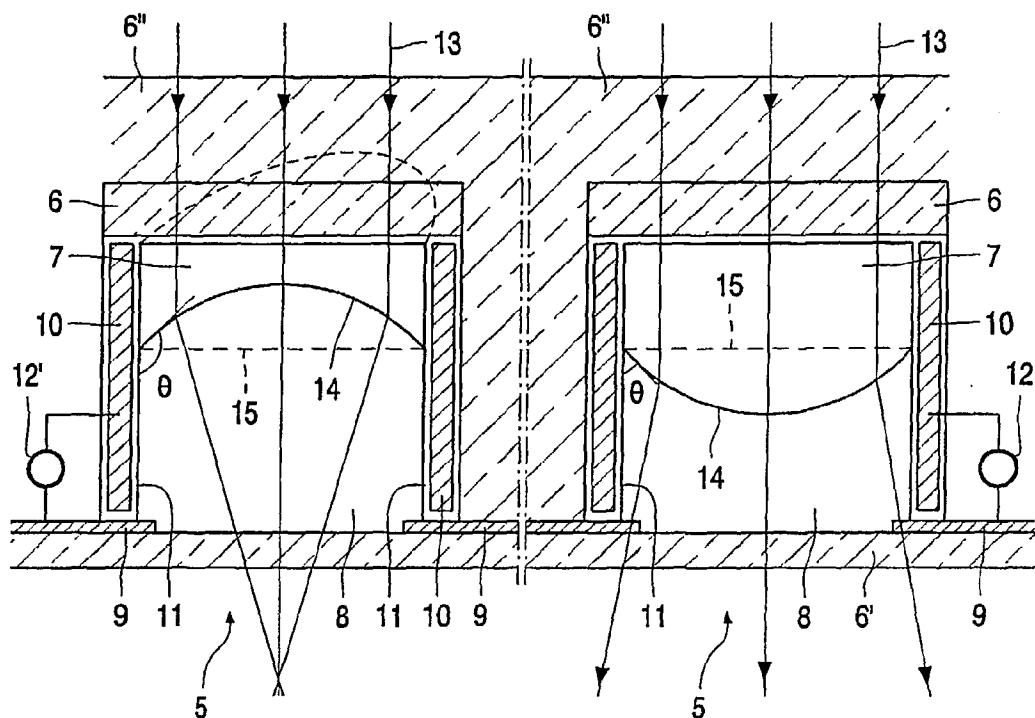


FIG. 1a

FIG. 1b

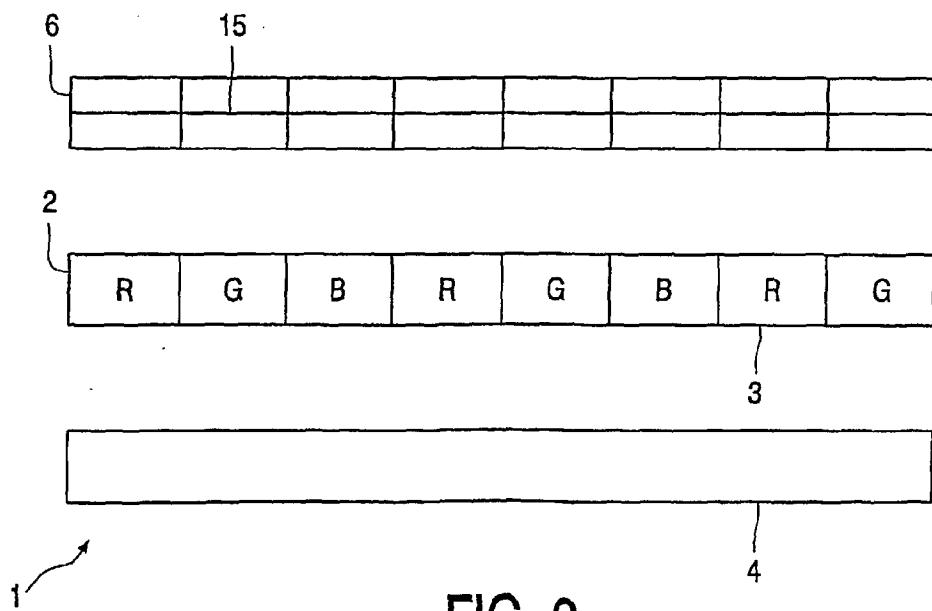


FIG. 2

2/5

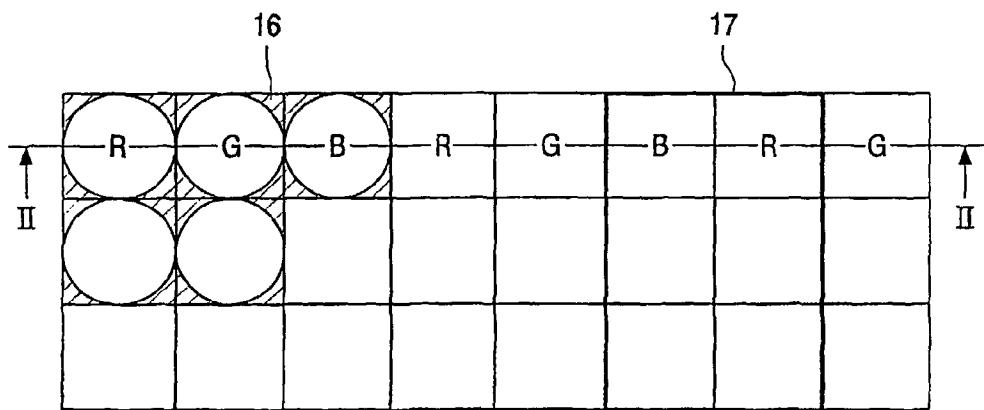


FIG. 3

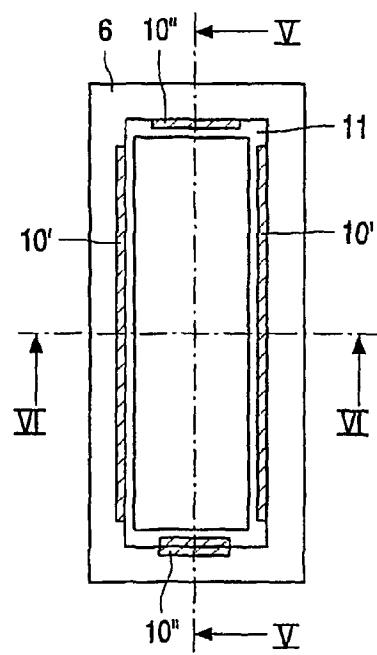


FIG. 4

3/5

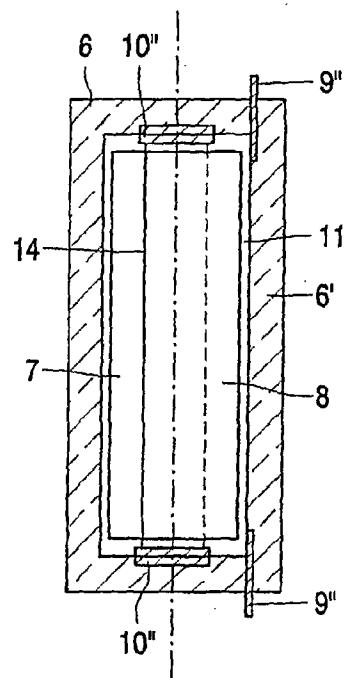


FIG. 5

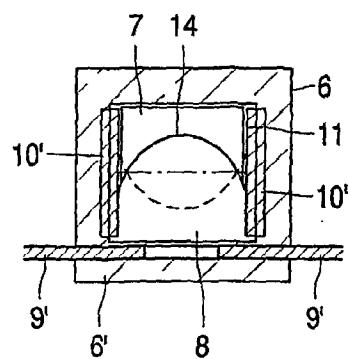


FIG. 6

4/5

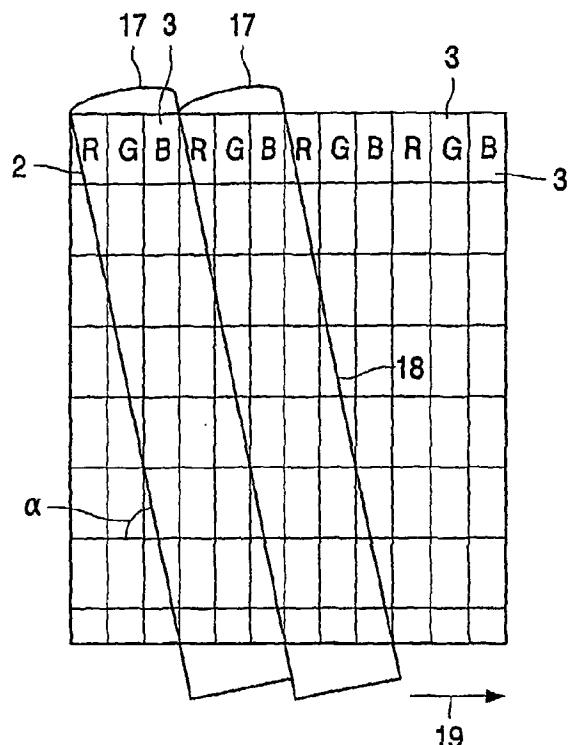


FIG. 7

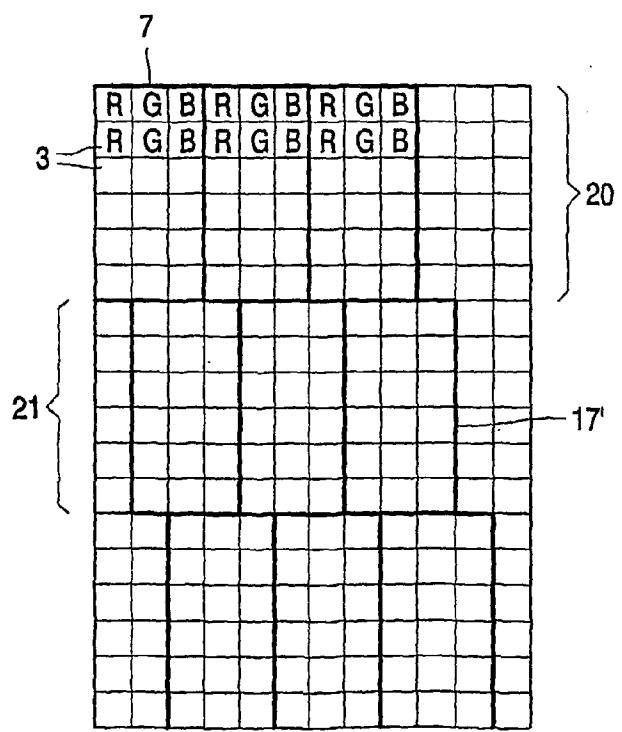


FIG. 8

5/5

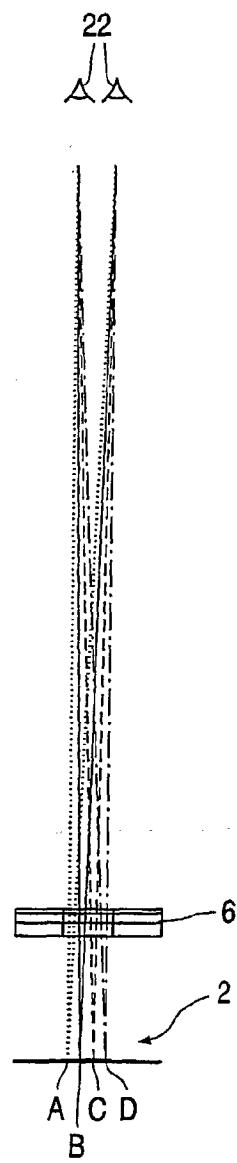
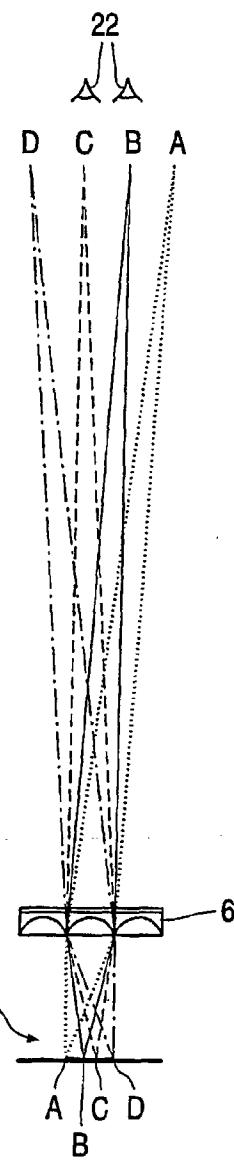


FIG. 9A

FIG. 9B

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 August 2003 (28.08.2003)

PCT

(10) International Publication Number  
**WO 03/071335 A3**

(51) International Patent Classification<sup>7</sup>: G02B 27/22, H04N 13/00, G02B 3/14

(21) International Application Number: PCT/IB03/00419

(22) International Filing Date: 6 February 2003 (06.02.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
02075687.0 20 February 2002 (20.02.2002) EP

(71) Applicant (for all designated States except US): KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): FEENSTRA, Bokke, J. [NL/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). VAN DE WALLE, Gerjan, F., A. [NL/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL). PRINS, Menno, W., J. [NL/NL]; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agent: RAAP, Adriaan, V.; Internationaal Octrooibureau B.V., Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

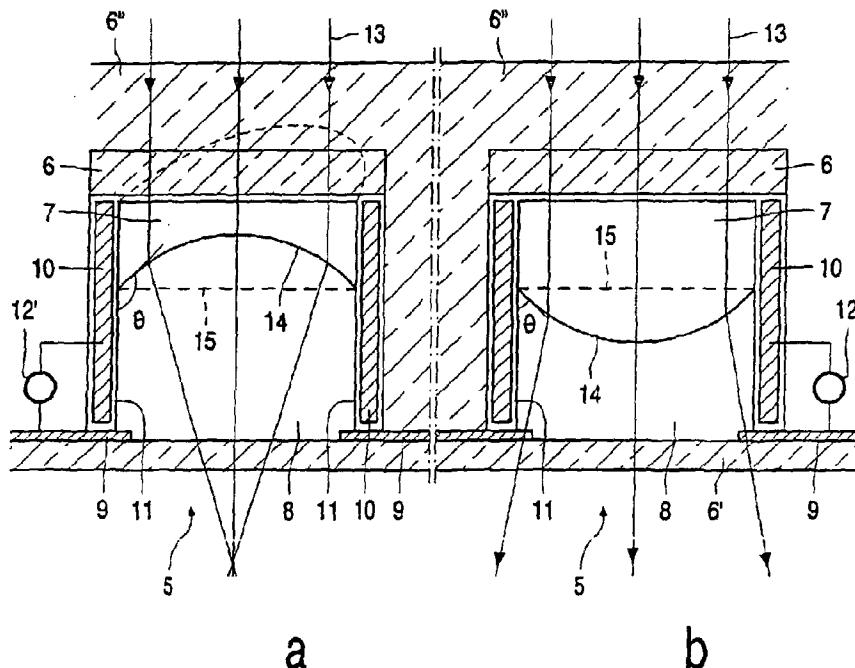
— with international search report

(88) Date of publication of the international search report:  
13 November 2003

[Continued on next page]

(54) Title: DISPLAY APPARATUS

WO 03/071335 A3



(57) Abstract: In a 2D/3D display, a switchable lenticular array having foci which can be switched in a continuous way between first focal strength and a second focal strength is provided. The switchable lenticular array comprises fluid cylindrical lens portions, while the foci can be controlled by electrowetting.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/IB 03/00419

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G02B27/22 H04N13/00 G02B3/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G02B H04N G09F G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	US 6 603 444 B1 (KAWANAMI ERIKO ET AL) 5 August 2003 (2003-08-05) column 2, line 35 -column 4, line 7; figures 1A-1C	1-3
X	-& JP 2000 356750 A (CANON INC) 26 December 2000 (2000-12-26) the whole document	1-3
X	WO 96 41227 A (MESO SCALE TECHNOLOGIES) 19 December 1996 (1996-12-19) page 2, line 29 - line 30 page 4, line 24 -page 6, line 31 page 9, line 12 -page 10, line 28; figure 1	1,3
	---	
	-/-	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority, claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

21 August 2003

Date of mailing of the International Search Report

29/08/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel: (+31-70) 340-2040, Tx: 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Ciarrocca, M

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/IB 03/00419

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GORMAN ET AL: "Control of the Shape of Liquid Lenses on a Modified Gold Surface Using an Applied Electrical Potential across a Self-Assembled Monolayer" LANGMUIR, vol. 11, no. 6, June 1995 (1995-06), pages 2242-2246, XP001164176 page 2242, left-hand column, paragraph 1 page 2243, right-hand column, paragraph 2 - paragraph 3; figure 3 page 2245, right-hand column, last paragraph ---	1
X	US 3 863 249 A (OLAH EMERY E) 28 January 1975 (1975-01-28) column 5, line 22 -column 6, line 25; figures 4A-5B ---	1
X	US 4 079 368 A (DISTEFANO THOMAS HERMAN) 14 March 1978 (1978-03-14) column 4, line 14 - line 37; figure 1 column 5, line 32 - line 38 figures 2A-2D ---	1
A	WO 00 58763 A (UNIV JOSEPH FOURIER ;BERGE BRUNO (FR)) 5 October 2000 (2000-10-05) figures 11,12 page 11, line 8 - line 12 ---	1,2
P,A	US 2002/176148 A1 (NOTO GORO ET AL) 28 November 2002 (2002-11-28) paragraph '0084! - paragraph '0086!; figure 2 & JP 2002 006200 A (CANON INC) 9 January 2002 (2002-01-09) & JP 2001 249261 A (CANON INC) 14 September 2001 (2001-09-14) & JP 2001 249262 A (CANON INC) 14 September 2001 (2001-09-14) & JP 2001 249203 A (CANON INC) 14 September 2001 (2001-09-14) ---	1
A	US 5 493 427 A (KATAGIRI MASAYUKI ET AL) 20 February 1996 (1996-02-20) column 15, line 59 -column 17, line 41; figure 13 column 18, line 21 -column 20, line 14; figure 15 ---	1
A	EP 0 791 847 A (PHILIPS ELECTRONICS NV) 27 August 1997 (1997-08-27) abstract; figures 1-3 ---	1,4-7
		-/-

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB U3/00419

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 069 650 A (BATTERSBY STEPHEN J) 30 May 2000 (2000-05-30) cited in the application the whole document -----	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB 03/00419

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 6603444	B1	05-08-2003	JP	2000356750 A		26-12-2000
WO 9641227	A	19-12-1996	US	6014259 A		11-01-2000
			US	5717453 A		10-02-1998
			US	5986811 A		16-11-1999
			AU	6276496 A		30-12-1996
			CA	2223126 A1		19-12-1996
			CN	1193389 A		16-09-1998
			EP	0871917 A1		21-10-1998
			JP	11513129 T		09-11-1999
			WO	9641227 A1		19-12-1996
			US	6437920 B1		20-08-2002
			ZA	9604888 A		12-06-1997
US 3863249	A	28-01-1975		NONE		
US 4079368	A	14-03-1978	DE	2719505 A1		08-12-1977
			FR	2352364 A1		16-12-1977
			GB	1573165 A		13-08-1980
			JP	52140233 A		22-11-1977
WO 0058763	A	05-10-2000	FR	2791439 A1		29-09-2000
			AT	244898 T		15-07-2003
			AU	3439200 A		16-10-2000
			CA	2368553 A1		05-10-2000
			DE	60003797 D1		14-08-2003
			EP	1166157 A1		02-01-2002
			WO	0058763 A1		05-10-2000
			JP	2002540464 T		26-11-2002
US 2002176148	A1	28-11-2002	JP	2001249261 A		14-09-2001
			JP	2001249262 A		14-09-2001
			JP	2001249203 A		14-09-2001
			JP	2002006200 A		09-01-2002
US 5493427	A	20-02-1996	JP	2944850 B2		06-09-1999
			JP	6335030 A		02-12-1994
			JP	2840012 B2		24-12-1998
			JP	7075135 A		17-03-1995
			JP	2920051 B2		19-07-1999
			JP	7072445 A		17-03-1995
			JP	2862462 B2		03-03-1999
			JP	7077748 A		20-03-1995
EP 0791847	A	27-08-1997	DE	69718534 D1		27-02-2003
			EP	0791847 A1		27-08-1997
			JP	9236777 A		09-09-1997
			US	6064424 A		16-05-2000
US 6069650	A	30-05-2000	EP	0877966 A1		18-11-1998
			WO	9821620 A1		22-05-1998
			JP	2000503424 T		21-03-2000